AF/2874
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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Patent Application

Inventor(s):	D. T. Neilson R. Ryf		
Case:	8-4		
Serial No.:	09/896,085	**Group Art Unit:**	2874
Filed:	June 29, 2001		
Examiner:	Kevin S. Wood		
Title:	Imaging Technique For Use With Optical MEMS Devices		

THE COMMISSIONER OF PATENTS AND TRADEMARKS
WASHINGTON, D.C. 20231
SIR:

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Appellant's Brief Under 37 C.F.R. 1.192

This is an appeal to the Board of Patent Appeals and Interferences from the Final Rejection dated April 6, 2004. Applicants are submitting this Brief in triplicate.

A Notice of Appeal was timely filed.

Real Party in Interest

The real party in interest is Lucent Technologies Inc.

Related Appeals and Interferences

There are no related appeals or interferences.

Status of Claims

Claims 1-20, 22-24 and 27-32 are pending in this application.

Claims 11 and 12 stand allowed.

Claims 1-10, 13-20, 22-24 and 27-32 stand finally rejected. A copy of the claims under appeal as now presented are appended to this brief in Appendix A.

Status of Amendments

All amendments to the claims have been entered.

Summary of the Invention

One solution for all-optical switching employs two MEMS devices each containing an array of tiltable micro mirrors, e.g., small mirrors, which can reflect light, which herein refers to any radiation in the wavelength of interest, whether or not in the visible spectrum. An optical path is established for light supplied from an input source, e.g., an optical fiber, to an output, e.g., an output fiber, by steering the light using a first micro mirror on the first optical MEMS device, the first micro mirror being associated with the input fiber, onto a second micro mirror on the second optical MEMS device which is associated with the output fiber. The second micro mirror then steers the light into the output fiber. Each fiber connected to the system is considered a port of the system, the input fibers being the input ports and the output fibers being the output ports.

A problem in the art of all-optical switching using MEMS devices is that in order to increase number of ports in the system, i.e., the number of fibers, it has been necessary to increase the number of micro mirrors employed to perform the switching function. In the prior art, as noted above, the first optical MEMS device contained all of the first micro mirrors integrated thereon and the second optical MEMS device contained all of the second micro mirrors integrated thereon. Since the size of the optical MEMS device is a direct function of the number of micro mirrors on the optical MEMS device, and the number of micro mirrors required is directly proportional to the maximum number of ports available in the all-optical switch, to increase the maximum number of ports available in the all-optical switch requires one to employ a larger optical MEMS device.

Unfortunately, limitations on manufacturing capability and the large package size have effectively limited the optical MEMS device at the present time to 1296 micro mirrors. Furthermore, even if the size of the micro mirrors could be effectively shrunk, there is still a problem in that there needs to be control signals brought to each micro mirror. These control signals consume large amounts of space on the optical MEMS device, which would thus result in the optical MEMS device being very large.

Additionally, there are control signals for each micro mirror that must be brought to the optical MEMS device from off of its substrate. In order to make these connections, additional large amounts of space is required on the optical MEMS device.

As a result of all these space requirements, the optical MEMS chip is quite large, and so, due to the manufacturing capability limits, the number of micro mirrors that can be placed on a single optical MEMS device is limited. The limitation on the number of micro mirrors, in turn, limits the number of ports of an all-optical switch.

Additionally, the micro mirrors presently available have a limited effective range through which they can be tilted. The limitation on the effective range further limits the number of ports that can be implemented in an all-optical switch employing such optical MEMS devices, because each micro mirror on the first optical MEMS device must be able to direct the light incident on it to each of the micro mirrors on the second optical MEMS device. The ability to so direct the light is a function of the effective tilt range of the micro mirrors. In other words, greater effective tilt angle allows each micro mirror to direct its light over a greater area. For optical MEMS devices arranged as an optical switch the greatest tilt angle required is for connections between micro mirrors in the opposing corners of the optical MEMS devices. For example, the most tilt is required by a micro mirror at the top right of the first MEMS device which must direct its light to a micro mirror at the bottom left of the second MEMS device. Thus, the size of the micro mirror array that can be employed in an optical switch is limited by the effective tilt range of its optical MEMS devices.

While increasing the separation distance between the two optical MEMS devices decreases the required tilt angle, which would allow the use of larger micro mirror arrays without changing the effective tilt range of the micro mirrors, doing so suffers from the disadvantage that it increases the beam diffraction, which thus requires the use of a micro mirror with a larger diameter or results in a loss of some of the light. Since using a larger micro mirror with present technology requires additional space, doing so increases the distance between the micro mirrors on the optical MEMS device, which further increases the size of the optical MEMS device for the same number of micro mirrors. As a result of increasing the size of the optical MEMS device, a greater tilt angle is required to couple the opposing corners of the opposing optical MEMS devices. Thus, essentially, additional separation of the opposing optical MEMS devices does not help to increase the number of ports due to the limited available tilt angle.

In accordance with the principles of the invention, the limitations on the number of ports in an all-optical switch due to the constraints on the size and/or effective tilt range of the optical MEMS devices can be overcome when a large enough micro mirror

array can be constructed but the tilt angle available is insufficient so that not all of the micro mirrors can be coupled together, by imaging at least a portion of one of the optical MEMS devices to a different location at which a second optical MEMS device is located in a manner that effectively **combines** the tilt angles of at least one micro mirror of each of the first and second optical devices. In one embodiment of the system, the imaging system reproduces the angle of reflection of the light from the first micro mirror, which may be achieved using a telecentric system, also known as a 4 f system. The physical size of the arrangement may be reduced by compacting the optical path, e.g., using appropriate conventional mirrors, and/or employing folded arrangements, i.e., arrangements in which there is only one MEMS device stage that does double duty for both input and output through the use of at least one conventional mirror.

In one embodiment of the invention, in order to create an optical switch with a larger apparent tilt angle, a first input optical MEMS device is imaged using a telecentric system onto a second input optical MEMS device so that the angles of reflection are added. The light reflected from the second input optical MEMS device is then supplied to an at least third output MEMS device. The third MEMS output device may in turn be imaged by a telecentric system onto a fourth output MEMS device.

In another embodiment of the invention, a folded system may be achieved using only two MEMS devices. The ports of the first MEMS device is allocated between input and output ports. The first MEMS device is imaged using a telecentric system onto a second MEMS device so that the angles of reflection are added. The light from the second MEMS device is bounced off a conventional mirror back toward the second MEMS device. The combined angle of the micro mirrors which reflected the light determines which micro mirror will receive the light after it bounces off of the conventional mirror. The micro mirror that receives the light after it bounces off of the conventional mirror in turn passes the light back through the imaging system to the first MEMS device, and the micro mirror thereon to which it is directed steers the light to an output port. Again, the angles of reflection between the second and first micro mirrors is additive.

The overall system is arranged to account for inversion of any images of the MEMS devices.

Advantageously, increasing the effective angle enables full connectivity between all available input and output ports of a switch that is made from MEMS devices with micro mirror arrays that are so large that not all of the micro mirrors on the input MEMS device could otherwise be coupled to all of the micro mirrors of the output MEMS device using the basic tilt angle of the MEMS device.

Issues

I. Are claims 1-8, 13, 15-20-27, and 30-32 properly rejected under 35 U.S.C. 102(e) as being anticipated by United States Patent No. 6,330,102 issued to Daneman et al. on December 11, 2001.

II. Are claims 9, 10, 14, 28, and 29 properly rejected under 35 U.S.C. 103(a) as being unpatentable over United States Patent No. 6,330,102 issued to Daneman et al.

Grouping of Claims

Claims 1-20, 22-24 and 32 are apparatus claims. Claims 27-31 are method claims.

Claims 1, 11, and 19, 27, 32 are independent claims.

For purposes of this appeal, claims 1-10 and 13-18, 20-24 stand together, claim 19 stands as a separate group, claims 27-31 stand as a separate group, and claim 32 stands as a separate group, as each independent claims has different wording.

Claims 11 and 12 stand as a separate, already allowed, group.

Arguments

Issue I – Rejection of Claims 1-8, 13, 15-20-27, and 30-32 under 35 U.S.C. 102

Claims 1-8, 13, 15-20-27, and 30-32 are rejected under 35 U.S.C. 102(e) as being anticipated by United States Patent No. 6,330,102 issued to Daneman et al. on December 11, 2001.

Generally, Daneman et al. does **not** disclose all the limitations of the claimed invention. In particular, Daneman et al. does **not** disclose that at least one of the micro mirrors of the first MEMS device is grouped by the first imaging system with at least one of the micro mirrors of the second MEMS device such that the angle of reflection from the at least one grouped micro mirror of the first MEMS device and the angle of reflection from the at least one grouped micro mirror of the second MEMS device combine to produce an overall effective angle about the first axis for the group which is different than either the angle of reflection from the at least one grouped micro mirror of the first MEMS device and the angle of reflection from the at least one grouped micro mirror of the second MEMS device when neither one of the angle of reflection from the

at least one grouped micro mirror of the first MEMS device and the angle of reflection from the at least one grouped micro mirror of the second MEMS device is zero. This limitation is **not** taught by Daneman et al. because the micro mirrors of the various MEMS devices of Daneman et al. that are coupled by an imaging system, e.g., to form an input or an output module, rotate about mutually **orthogonal** axes. Thus, the rotation of the coupled MEMS devices of Daneman et al. do not combine in the **same** direction, so that the combined angle about a specified axis is the same as the angle for the MEMS device that is rotating about the specified axis. As a result, effectively, in Daneman et al., and in contrast to applicants' claims, the angle of reflection about the first axis of all of the micro mirrors of at least one of the grouped MEMS devices device is zero, a case specifically excluded by applicants' claims.

To delve more deeply, the Office Action states that it is clear that the Daneman et al. reference provides multiple MEMS devices, where each has a plurality of mirrors, each of these mirrors being able to rotate about a single axis. Applicants agree with this statement.

The Office Action further states that it is also clear that the system of FIG. 4, having two MEMS devices, each containing a plurality of mirrors capable of rotating about a single axis, would be capable of producing a combined angle of reflection greater than either the first or second angle of reflection about a specified axis. This statement and conclusion of the Office Action is incorrect.

There seems to a misunderstanding by the Office Action as to the meaning of orthogonal axes, and the ability of rotations about axes to combine, especially when the axes are orthogonal.

Simply put, rotations about orthogonal axes do **not** add so as to change the rotation about any one of the axes.

Consider, for pedagogical purposes, the example of a single device with the ability to rotate around two-orthogonal axes. Lets suppose the device starts from a zero rotation about each axis and is then rotated 50 degrees about its first axis. The device now has a rotation about the first axis of 50 degrees, and it still has a rotation of zero degrees about the second axis. This can be thought of as (50, 0). Now the device rotates 30 degrees about the second axis. The device now has a 30 degree rotation about the second axis and it **still** has the **same** 50 degree rotation about the first axis. This can be thought of as (50, 30). In other words, rotating about the second axis had **absolutely no effect** on the total rotation about the first axis. The total rotation about the first axis remained the same.

Effectively, rotating about the second axis added **zero** to the rotation about the first axis. This is because rotations about orthogonal axes do **not** combine. This is analogous to the operation of the system of Daneman et al., and it has been explicitly excluded by applicants' claim language, which requires that neither of the angles of reflection of the grouped micro mirrors be zero.

By contrast, suppose we again start from a zero rotation about each axis and rotate 50 degrees about the first axis. The device now has a rotation about the first axis of 50 degrees, and it still has a rotation of zero degrees about the second axis. This can be thought of as (50, 0). Now we rotate the device again another 30 degrees about the first axis. The device now has an 80 degree rotation about the first axis and it **still** has the **same** 0 degree rotation about the second axis. This can be thought of as (80, 0). In other words, the rotations about the first axis have added to provide a new total rotation about the first axis. This is analogous to the operation of the applicants' invention as claimed.

Since the component of rotation about one axis does not contribute in any way to the component of rotation about the other axis, the Office Action's conclusion must be incorrect.

Given the foregoing, it is clear to applicants that the Office Action is attempting to add the angles of rotations of MEMS devices in Daneman et al. that can**not**, and should **not**, be combined given the language of applicants' claims.

Firstly, the Office Action is **not** taking into proper account the effect of applicants' recited limitation that the angles of reflection of the MEMS devices that are combined are combined about the **first** axis. This is only possible when both of the angles of reflections that are being combined are about the same first axis. By contrast, in Daneman et al., the angles of reflections of each of the MEMS devices therein that are coupled by an imaging system are about different axes. These Daneman et al. angles of reflection can**not** be combined at all.

Secondly, it appears that the Office Action believes that the rotations of any of the MEMS devices disclosed by Daneman et al. can be added together. This is incorrect. Only those MEMS device that are coupled by an imaging system between them can have their rotations about a **single** axis combined. Accordingly, in Daneman et al. a) only MEMS devices 212 may be combined with MEMS device 214 via the imaging system between them as a first group, and b) only MEMS devices 222 may be combined with MEMS device 224 via the imaging system between them as a second group. It therefore follows that MEMS device 212 can**not** be combined with MEMS device 222 and that MEMS device 214 can**not** be combined with MEMS device 224.

Given that the mirrors of MEMS devices 212 rotate about an axis that is mutually orthogonal to the axis about which the mirrors of MEMS device 214 rotate (see Daneman et al., column 4, lines 24-25), this grouping can**not** have an effective rotation about any of its axes that is different than the rotation about that axis for the one of the MEMS device that is rotated only about that axis. Similarly, given that the mirrors of MEMS devices 222 rotate about an axis that is mutually orthogonal to the axis about which the mirrors of MEMS device 224 rotate (see Daneman et al., column 4, lines 27-28), this grouping can**not** have an effective rotation about any of its axes that is different than the rotation about that axis for the one of the MEMS device that is rotated only about that axis.

In response to the foregoing, the Office Action has stated that, although there are some MEMS devices in Daneman et al. that rotate about mutually orthogonal axes, there are, however, pairs of MEMS device disclosed by Daneman et al. that have mirrors that rotate about a common axis. To this end, the Office Action cites MEMS devices 212 and 224 that have mirrors that rotate about a common axis.

Applicants agree that the mirrors of MEMS devices 212 and 224 rotate about a common axis.

However, that fact is irrelevant to applicants' claims, since the rotations of the mirrors of those devices do **not** combine as recited in applicants' claims.

The simple presence of MEMS devices that rotate about a common axis is not sufficient to meet applicants' claims' limitations. This is because applicants' claims require "a first imaging system optically coupled to said first MEMS device so as to produce an image of each of said micro mirrors of said first MEMS device on a corresponding micro mirror of said second MEMS device".

However, despite the Office Action's suggestion to the contrary, in Daneman et al, the mirrors of MEMS devices 212 and 224 are **not** coupled by an imaging system. Instead, imaging system 216 causes the mirrors of MEMS device 212 to be combined **only** with the mirrors of MEMS device 214. Similarly, imaging system 226 causes the mirrors of MEMS devices 222 to be combined **only** with the mirrors of MEMS device 224. (See Daneman et al., column 4, lines 24-43.)

It therefore follows that the mirrors of MEMS device 212 are **not** combined with the mirrors of MEMS device 224 as suggested by the Office Action. Nor is there any suggestion that the mirrors of MEMS device 214 can be combined by an imaging system with the mirrors of MEMS device 222.

Applicants acknowledge that one might be tempted to say that the mirrors of MEMS devices 212 and 224 are optically coupled, because light from MEMS device 212 eventually passes to MEMS device 224. However, mere optical coupling is **not** sufficient

to meet what is recited in applicants' claims, which, as noted, requires that the optical coupling produce an **image** of each of said micro mirrors of the first MEMS device on a corresponding micro mirror of the second MEMS device, and moreover, that such image be formed so that the resulting overall effective angle be different than either of the angles of reflection of the mirrors being combined when neither one of the angle of reflections is zero. However, in Daneman et al., there is **no** image formed by the simple optical coupling of MEMS devices 212 and 224. **Nor** is the requisite combination of angles achieved thereby.

Thus, the mere passing of light from MEMS device 212 to MEMS device 224 is **not** the coupling as completely characterized by applicants' claims. Such mere light passage does not anticipate nor suggest applicants' coupling recitation when all of the limitations of that recitation are properly included therein.

Applicants note that the Final Office Action disregards the requirement by applicants' claims that the coupling form an image, as discussed hereinabove. This is because, the Final Office Action states:

> The Examiner has used a first MEMS device (212) coupled to a second MEMS device (224) through a first imaging system (216), to reject the claims. These two MEMS devices (212, 224) clearly contain mirrors that rotate about the same axis, and therefore meet all the limitations of the claimed invention.

Although coupling is mentioned by the Final Office Action, image formation, clearly a requirement of applicants' claims, has **not** been taken into account.

Finally, the fact that Daneman et al. teaches the use of an imaging system to combine MEMS devices that have mirrors that rotate about orthogonal axes, yet does **not** teach to so combine the MEMS devices which are disclosed as having mirrors that rotate about the same axis, shows that Daneman et al. actually teaches away from applicants' invention as claimed.

Thus, there is no teaching or suggestion in Daneman et al. of combining angles about a common axis using an imaging system as recited in applicants' claims. Therefore, applicants' claims 1-8, 13, 15-20-27, and 30-32 are allowable over Daneman et al. under 35 U.S.C. 102.

Clearly then, all of applicants' claims are allowable under 35 U.S.C. 103.

Issue II – Rejection of Claims 9, 10, 14, 28, and 29 under 35 U.S.C. 103

Claims 9, 10, 14, 28, and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over United States Patent No. 6,330,102 issued to Daneman et al.

This ground of rejection is for dependent claims only, and is predicated on the ability to maintain the rejection above under 35 U.S.C. 102(e) over Daneman et al. Since the rejection above under 35 U.S.C. 102(e) over Daneman et al. has been overcome, as described hereinabove, and there are no additional elements related thereto in connection with the rejection under 35 U.S.C. 103, this ground of rejection cannot be maintained, because the rejected claims depend from independent claims which are allowable.

Therefore, claims 9, 10, 14, 28, and 29 are allowable over Daneman et al. under 35 U.S.C. 103(a).

Conclusion

In view of the foregoing, it is submitted that the Examiner is in error. It is, accordingly, respectfully requested that the rejection of claims 1-36 be reversed and the application passed to issue.

Respectfully,

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By Eugene J Rosenthal

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Date: 8/18/04

APPENDIX A

1. An optical switch, comprising

a first micro-electro mechanical system (MEMS) device containing a first number of micro mirrors tiltable about at least a first axis;

a second micro-electromechanical system (MEMS) device containing a second number of micro mirrors tiltable about at least said first axis; and

a first imaging system optically coupled to said first MEMS device so as to produce an image of each of said micro mirrors of said first MEMS device on a corresponding micro mirror of said second MEMS device;

so that at least one of said micro mirrors of said first MEMS device is grouped by said first imaging system with at least one of said micro mirrors of said second MEMS device such that the angle of reflection from said at least one grouped micro mirror of said first MEMS device and the angle of reflection from said at least one grouped micro mirror of said second MEMS device combine to produce an overall effective angle about said first axis for said group which is different than either the angle of reflection from said at least one grouped micro mirror of said first MEMS device and the angle of reflection from said at least one grouped micro mirror of said second MEMS device when neither one of the angle of reflection from said at least one grouped micro mirror of said first MEMS device and the angle of reflection from said at least one grouped micro mirror of said second MEMS device is zero.

2. The invention as defined in claim 1 wherein said first number and said second number are the same.

3. The invention as defined in claim 1 further comprising a plurality of optical source coupled to supply input light to said first MEMS device.

4. The invention as defined in claim 1 further comprising a plurality of optical source coupled to supply input light to said first MEMS device, wherein at least one of said optical sources are one of the group consisting of an optical fiber, a laser. a light emitting diode, light source, and a planar wave guide.

5. The invention as defined in claim 1 further comprising a receiver coupled to receive output light from said second MEMS device.

6. The invention as defined in claim 1 further comprising a receiver coupled to receive output light from said second MEMS device, each of said receiver being one of the group consisting of an optical fiber, a photo detector, and a planar wave guide.

7. The invention as defined in claim 1 wherein said first imaging system reproduces an angle of reflection of the light from each of said micro mirrors of said first MEMS device

8. The invention as defined in claim 1 wherein said overall effective angle for said group is a sum of said angle of reflection from each of said micro mirrors of said group.

9. The invention as defined in claim 1 further comprising a field lens for receiving light reflected by said second MEMS device.

10. The invention as defined in claim 1 further comprising a field lens through which light passes prior to being incident onto said first MEMS device.

11. An optical switch, comprising

a first micro-electro mechanical system (MEMS) device containing a first number of micro mirrors;

a second micro-electromechanical system (MEMS) device containing a second number of micro mirrors; and

a first imaging system optically coupled to said first MEMS device so as to produce an image of each of said micro mirrors of said first MEMS device on a corresponding micro mirror of said second MEMS device; and

a mirror for receiving light reflected by said second MEMS device and reflecting said light back toward said second MEMS device;

whereby at least one of said micro mirrors of said first MEMS device is grouped with at least one of said micro mirrors of said second MEMS device such that the angle of reflection from said at least one grouped micro mirror of said first MEMS device and the angle of reflection from said at least one grouped micro mirror of said second MEMS device combine to produce an overall effective angle for said group.

12. The invention as defined in claim 11 wherein said mirror is of a type selected from the group of types consisting of: planar and curved.

13. The invention as defined in claim 1 wherein said first number of micro mirrors and said second number of micro mirrors are the same.

14. The invention as defined in claim 1 wherein said first number of micro mirrors and said second number of micro mirrors are different.

15. The invention as defined in claim 1 wherein the size of said micro mirrors of said first device is the same as the size of said micro mirrors of said second device.

16. (Amended) The invention as defined in claim 1 wherein the size of said micro mirrors of said first device is different than the size of said micro mirrors of said second device.

17. The invention as defined in claim 1 wherein said imaging system is a telecentric system.

18. The invention as defined in claim 1 further comprising

a third micro-electromechanical system (MEMS) device containing a third number of micro mirrors;

a fourth micro-electromechanical system (MEMS) device containing a fourth number of micro mirrors; and

a second imaging system optically coupled to said third MEMS device so as to produce an image of each of said micro mirrors of said third MEMS device on a corresponding micro mirror of said fourth MEMS device;

whereby at least one of said micro mirrors of said third MEMS device is grouped with at least one of said micro mirrors of said fourth MEMS device such that the angle of reflection from said at least one grouped micro mirror of said third MEMS device and the angle of reflection from said at least one grouped micro mirror of said fourth MEMS device combine to produce an overall effective angle for said group of micro mirrors of said third and fourth MEMS devices.

19. An optical switch, comprising

a first micro-electro mechanical system (MEMS) device containing a first number of micro mirrors;

a second micro-electromechanical system (MEMS) device containing a second number of micro mirrors;

a first imaging system optically coupled to said first MEMS device so as to produce an image of each of said micro mirrors of said first MEMS device on a corresponding micro mirror of said second MEMS device; and

a third micro-electromechanical system (MEMS) device containing a third number of micro mirrors;

whereby at least one of said micro mirrors of said first MEMS device is grouped with at least one of said micro mirrors of said second MEMS device such that the angle of reflection from said at least one grouped micro mirror of said first MEMS device and the angle of reflection from said at least one grouped micro mirror of said second MEMS device combine to produce an overall effective angle for said group;

and wherein light reflected by said micro mirrors of said third MEMS device is coupled to said first MEMS device.

20. The invention as defined in claim 1 further comprising:

a third micro-electromechanical system (MEMS) device containing a third number of micro mirrors;

and wherein light reflected by said micro mirrors of said second MEMS device is coupled to said third MEMS device.

22. The invention as defined in claim 1 wherein said first MEMS device is arranged to act as a booster.

23. The invention as defined in claim 1 wherein each of said grouped micro mirrors effectively contribute different angles to said overall effective angle for said group.

24. The invention as defined in claim 1 wherein one of each of said grouped micro mirrors effectuates coarse tilt and the other effectuates fine control.

27. A method for operating an optical switch including a first micro-electromechanical system (MEMS) device containing a first number of micro mirrors tiltable about at least a first axis, a second micro-electromechanical system (MEMS) device containing a second number of micro mirrors tiltable about at least said first axis, the method comprising the step of:

imaging said first optical MEMS device onto said second optical MEMS device so that the angle of reflection from at least one micro mirror of said first optical MEMS device and the angle of reflection from at least one micro mirror of said second MEMS device combine to produce an overall effective angle about at least said first axis when considering said least one micro mirror of said first optical MEMS device and said at least one micro mirror of said second MEMS device as a group, said overall effective angle being different than either the angle of reflection from said at least one grouped micro mirror of said first MEMS device and the angle of reflection from said at least one grouped micro mirror of said second MEMS device when neither one of the angle of reflection from said at least one micro mirror of said first MEMS device and the angle of reflection from said at least one micro mirror of said second MEMS device that are being combined is zero.

28. The invention as defined in claim 27 further comprising the step of passing light from said second optical MEMS device through a field lens.

29. The invention as defined in claim 27 further comprising the step of receiving light from a field lens at said first optical MEMS device.

30. The invention as defined in claim 27 further comprising the step of coupling light passed from a fiber at said first optical MEMS device.

31. The invention as defined in claim 27 further comprising the step of coupling light from said second optical MEMS device to a fiber.

32. An optical switch, comprising

a first micro reflective means mounted on a first micro-electromechanical system (MEMS) means tiltable about at least a first axis;

a second micro reflective means mounted on a second micro-electromechanical system (MEMS) means tiltable about at least said first axis;

a first imaging means optically arranged to produce an image of said first micro reflective means at said second micro reflective means such that the angle of reflection of said first micro reflective means and the angle of reflection from said second micro reflective means combine about said first axis to produce an overall effective reflective angle that is different than either the angle of reflection of said first micro reflective means and the angle of reflection from said at least second micro reflective means when neither one of the angle of reflection from said first micro reflective means and the angle of reflection from said second micro reflective means is zero.

Serial No. 09/896,085

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): D. T. Neilson
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Title: Imaging Technique For Use With Optical MEMS Devices

THE COMMISSIONER FOR PATENTS
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Enclosed is an Appellant's Brief Under 37 C.F.R. 1.192 Before the Board of Patent Appeals and Interferences in the above-identified appeal.

Please charge the amount of $330.00, covering payment of the fee for the Appeal Brief, to **Lucent Technologies Inc. Deposit Account No. 12-2325**. In the event of any non-payment or improper payment of a required fee, the Commissioner is authorized to charge Deposit Account No. 12-2325 as required to correct the error.

Respectfully submitted,

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8/18/04
Date

Sharon LoBosco